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Participation of oxygen in the bacterial transformation of 2,4,6-trinitrotoluene

Naumenko E., Naumov A., Suvorova E., Gerlach R., Ziganshin A., Lozhkin A., Silkin N., Naumova R.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

The exposure of Bacillus cereus ZS18 cell suspensions to 2,4,6-trinitrotoluene (TNT) in the absence of other oxidizable substrates increases oxygen uptake, exceeding the basal level of respiration of the bacterium 1.5- and 2-fold with 50 and 100 mg/liter of TNT, respectively. The interaction of both living and to less extent dead bacterial cells with TNT results in the accumulation of superoxide anion ($O_2^{\cdot-}$) in the extracellular medium, which was revealed by the EPR spectroscopy. The accumulation of O2 decreased by 50-70% in the presence of Cu,Zn-superoxide dismutase of animal origin. In the presence of living bacterial cells, the level of TNT decreased progressively, yielding hydroxylaminodinitrotoluenes together with O2. In the presence of heat-killed cells, a moderate decrease in TNT was observed, and the appearance of O2 was not accompanied by the production of any detectable TNT metabolites. Chelating agents inhibited the transformation of TNT and decreased the formation of O2. The demonstrated generation of O2 during the interaction of TNT with K4[Fe(CN) 6] together with the observed effects of chelating agents suggest the participation of iron in the one-electron reduction of TNT and the functioning of an extracellular redox cycle with the involvement of molecular oxygen. © 2008 MAIK Nauka.

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Keywords

2,4,6-trinitrotoluene, Aerobic transformation, Superoxide anion